AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in Charge]

By L. T. SAMUELS

Airplane observations were not made at Boston during June. They were begun at Barksdale Field, Shreveport, La., on June 15, and discontinued at Spokane by the National Guard on June 8.

At those stations with a sufficient period of record for the determination of approximate normals, upper-air temperatures during June averaged below normal, except in the higher levels at Norfolk and San Diego. (See table 1.) The lowest average upper-air temperatures occurred at Seattle and Spokane. Upper-air relative humidities averaged above normal in practically all cases with small to moderate departures. The relative humidities in the highest levels averaged greatest over Billings and Oklahoma City and lowest over San Diego.

The resultant winds for the month were in general as follows: At the 2,000 and 4,000-meter levels, the directions were close to normal and the velocities mostly above normal, with extremely large departures in the latter over the Middle Mississippi and Ohio River Valleys and extreme Northwest.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during June 1935*

TEMPERATURE (° C.)

Stations	Altitude (meters) m. s. l.																
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		Number of observations
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	
Barksdale, La.[2] (52 m)	22.7		23.9		20.9		18.4		15.9		12.7		9.8		3.5		−2.6		16
Billings, Mont.[1] (1,088 m)	11.7						14.6		12.2		8.6		5.0		−1.9		−8.5		30
Cheyenne, Wyo.[1] (1,873 m)	9.5								10.8		11.4		8.5		1.0		−7.1		30
Fargo, N. Dak.[1] (274 m)	12.0		13.5		12.8		10.0		7.1		4.1		1.4		−4.2		−10.4		30
Kelly Field (San Antonio), Tex.[2] (206 m)	22.7		22.7		20.7		18.4		15.8		12.8		9.8		2.5		−4.3		27
Lakehurst, N. J.[3] (3 m)	18.3		19.4		17.5		15.0		11.8		9.2		7.1		2.9		−1.6		25
Maxwell Field (Montgomery), Ala.[2] (52 m)	21.5		22.6		19.8		16.3		13.3		10.2		7.3		1.1		−4.6		28
Mitchel Field (Hempstead, L. I.), N. Y.[2] (29 m)	16.1		17.5		15.3		12.8		9.8		7.0		4.7		0.0		−6.1		27
Murfreesboro, Tenn.[1] (174 m)	17.9		20.0		17.8		15.0		12.2		9.3		6.6		0.5		−5.1		30
Norfolk, Va.[3] (10 m)	21.1	−1.7	21.5	−0.1	20.2	+0.7	17.5	+0.9	14.4	+0.9	11.2	+0.5	8.7	+0.7	3.7	+0.7	−1.0	+0.7	27
Oklahoma City, Okla.[1] (391 m)	19.4		19.9		19.4		17.3		14.9		12.1		9.0		1.8		−5.4		30
Omaha, Nebr.[1] (300 m)	15.9	−2.9	16.9	−3.3	16.7	−4.2	13.9	−4.4	11.1	−4.2	7.9	−3.8	4.8	−3.3	−1.3	−2.7	−7.5	−2.2	30
Pensacola, Fla.[3] (24 m)	23.1	−1.7	22.7	−0.4	19.3	−1.0	15.9	−1.6	13.3	−1.3	10.3	−1.5	7.3	−1.6	1.3	−1.9	−4.5	−1.9	30
San Diego, Calif.[3] (10 m)	16.8	−2.2	13.8	−1.9	18.1	+1.0	22.0	+4.2	20.2	+2.9	17.4	+2.8	14.2	+2.6	8.1	+2.8	0.7	+2.8	30
Scott Field (Belleville), Ill.[2] (135 m)	16.8		19.6		17.8		14.9		11.9		8.9		6.4		1.2		−4.4		29
Seattle, Wash.[3] (25 m)	12.6	−2.7	11.2	−1.1	9.3	−0.5	6.6	−0.7	4.2	−0.6	2.2	−0.3	0.0	−0.1	−5.0	−0.4	−10.8	−0.5	30
Selfridge Field (Mount Clemens), Mich.[2] (177 m)	14.3		15.9		13.4		10.1		7.3		4.5		2.1		−3.2		−9.2		28
Spokane, Wash.[4] (596 m)	16.0				14.4		11.6		8.4		4.7		1.6		−4.7		−11.0		8
Sunnyvale, Calif.[3] (10 m)	16.9		15.6		18.3		19.0		16.8		14.1		11.2		4.4		−3.3		23
Washington, D. C.[3] (13 m)	17.7	−4.1	18.6	−1.6	17.1	−1.0	14.2	−1.2	10.8	−1.7	7.6	−1.7	4.8	−2.1	−0.1	−1.1	−5.4	−0.4	25
Wright Field (Dayton), Ohio[2] (244 m)	15.1		17.3		15.6		12.4		9.4		6.9		4.3		−1.2		−7.1		30

RELATIVE HUMIDITY (PERCENT)

Barksdale, La.	87		66		68		61		52		47		41		48		41		
Billings, Mont.	71						53		51		55		59		60		55		
Cheyenne, Wyo.	81								71		50		45		43		45		
Fargo, N. Dak.	85		73		63		64		64		65		59		45		38		
Kelly Field (San Antonio), Tex.	96		88		77		69		63		59		56		56		50		
Lakehurst, N. J.	83		61		60		63		64		62		52		43		34		
Maxwell Field (Montgomery), Ala.	83		64		59		59		57		53		52		49		42		
Mitchel Field (Hempstead, L. I.), N. Y.	92		72		73		71		71		68		63		51		43		
Murfreesboro, Tenn.	88		69		68		70		68		61		55		53		51		
Norfolk, Va.	86	+10	74	+6	67	+4	67	+5	70	+9	72	+14	66	+12	58	+12	48	+12	
Oklahoma City, Okla.	88		81		69		64		61		56		55		55		56		
Omaha, Nebr.	89	+8	78	+7	64	+8	60	+6	59	+8	57	+6	54	+3	52	+4	45	+3	
Pensacola, Fla.	84	+3	74	−1	72	+2	69	+1	63	−2	60	−1	58	+1	53	+2	53	+6	
San Diego, Calif.	84	+12	91	+12	61	+3	33	−6	25	0	22	+1	20	+2	17	+2	14	+2	
Scott Field (Belleville), Ill.	92		69		65		66		69		68		63		55		50		
Seattle, Wash.	79	+7	77	+3	74	0	73	+1	72	+2	68	+3	63	+4	54	+4	50	+4	
Selfridge Field (Mount Clemens), Mich.	87		65		65		71		69		66		58		42		41		
Spokane, Wash.	43				45		48		49		48		46		46		41		
Sunnyvale, Calif.	73		72		54		41		36		32		30		28		28		
Washington, D. C.	87	+17	72	+8	68	+7	68	+7	71	+9	71	+12	63	+8	53	+5	46	+7	
Wright Field (Dayton), Ohio	89		73		68		69		65		56		51		46		38		

[1] Weather bureau. [2] Army. [3] Navy. [4] National Guard.

Observations taken about 5 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on "normals" covering the following number of observations made during the same month in previous years, including the current year: Norfolk, 141; Omaha, 120; Pensacola, 187; San Diego, 144; Seattle, 61; Sunnyvale, 65; Washington, 202.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during June 1935*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (189 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	335	1.0	313	0.7	305	1.9	278	1.1	264	2.6	211	1.3	180	0.2	242	1.2	238	1.5	122	1.1	135	1.8	287	0.6	195	1.3
500	------	------	292	1.6	------	------	287	6.7	------	------	241	4.3	240	4.2	256	3.7	268	3.2	181	6.8	138	3.1	295	1.2	220	3.4
1,000	------	------	270	3.1	------	------	284	3.9	------	------	249	5.0	254	6.8	251	5.9	288	4.8	179	7.3	140	2.3	296	2.1	243	5.6
1,500	------	------	267	3.9	306	3.0	278	4.9	------	------	259	5.6	262	6.9	263	6.1	296	5.9	178	6.8	149	1.4	280	0.8	250	5.8
2,000	246	1.1	260	5.0	288	3.5	274	6.8	246	3.9	264	6.4	263	8.1	264	6.8	293	7.1	188	6.0	169	1.1	296	1.8	248	6.2
2,500	275	3.6	265	5.7	281	5.1	271	7.9	245	5.1	262	7.2	263	8.9	261	7.3	284	7.6	192	4.8	184	0.7	270	3.6	255	5.9
3,000	293	5.1	261	5.2	280	7.3	267	8.7	275	6.4	267	8.5	261	9.5	263	7.3	279	9.3	190	2.9	197	0.4	257	5.2	271	5.6
4,000	299	5.3	281	6.6	279	11.7	256	7.6	287	11.0	------	------	251	11.0	288	7.0	302	13.2	194	2.0	284	0.8	263	8.2	286	3.7
5,000	281	3.4	265	6.4	290	15.2	------	------	287	12.0	------	------	------	------	282	7.8	303	15.1	273	2.0	268	3.8	256	9.8	------	------

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii[1] (68 m)		Pensacola, Fla.[1] 24 (m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	318	0.6	222	0.4	187	3.0	177	0.7	53	2.6	316	0.8	221	1.8	152	2.5	197	0.8	275	0.3	151	1.4	109	0.6	282	0.5
500	293	4.2	277	1.8	191	5.3	225	2.1	73	6.2	238	0.8	238	5.4	------	------	237	1.2	269	1.5	227	1.5	------	------	290	3.9
1,000	278	6.1	320	5.5	214	10.8	261	4.8	67	4.4	223	2.2	255	6.6	------	------	------	------	256	2.9	236	2.5	218	2.6	289	5.0
1,500	277	6.8	338	3.9	233	8.4	269	5.5	73	6.1	218	2.7	268	7.9	166	2.3	------	------	250	4.2	229	4.0	252	3.4	279	5.9
2,000	280	8.0	330	3.2	241	8.7	278	6.6	69	5.7	271	2.0	270	9.4	264	1.0	------	------	260	5.1	233	4.8	254	4.5	269	8.4
2,500	272	8.7	318	4.7	263	7.8	283	7.3	49	3.1	298	1.4	280	8.9	285	2.5	------	------	265	5.6	249	4.9	254	5.2	271	8.9
3,000	283	7.0	307	4.6	276	5.1	296	8.5	62	3.2	313	2.2	276	8.7	290	4.6	------	------	291	4.4	255	6.3	260	6.2	267	8.5
4,000	------	------	307	6.1	303	5.5	------	------	------	------	342	3.6	------	------	275	9.0	------	------	299	8.5	272	7.7	277	8.8	278	8.7
5,000	------	------	------	------	------	------	------	------	------	------	------	------	------	------	270	14.6	------	------	303	10.7	------	------	271	6.0	------	------

[1] Navy stations.

RIVERS AND FLOODS

[River and Flood Division, MONTROSE W. HAYES, in charge]

By RICHMOND T. ZOCH

The most disastrous floods during June were those in the Missouri Basin and in the Colorado, Guadalupe, and Nueces Rivers of Texas.

Exceptionally heavy rains on May 31 and June 1 over the Republican River Valley caused a very destructive flood throughout the length of this river in both Nebraska and Kansas. The next paragraph gives an account of the damage in the State of Nebraska; following it the report of the official in charge, Weather Bureau office, Topeka, Kans., is quoted, and the effects of the flood in Kansas are described.

About 250,000 acres of land in Nebraska were flooded, forming a strip along the river throughout its length in the State (210 miles) and from 1 to 3 miles wide. One hundred and four persons were drowned, more than 1,000 families were made homeless and the buildings on more than 600 farms were washed away. Two hundred and thirteen miles of railway tracks were also washed away. This flood was the worst in Nebraska since the coming of the white man, and the total property damage has been estimated at $13,000,000. Needless to say, the highest stage of record was reached at Guide Rock, Nebr., which is the uppermost river gage maintained by the Weather Bureau on the Republican River.

Floods were caused by the same storm in the South Platte, North Platte, and Nemaha Rivers of Nebraska, but they were not serious.

Besides the flood in the Republican River, there were severe floods in the other rivers of the Kansas system in Kansas. The highest stages of record were reached at the following river gage stations: Scandia, Concordia, Manhattan, and Beloit (all in the Kansas River Basin in Kansas). Six persons were drowned by these floods. The official in charge, Weather Bureau office, Topeka, Kans., comments as follows on the floods in the Kansas River Valley:

The Republican flood the first 3 days of the month, the worst in the State, moved very rapidly and swept away nearly all bridges and many small buildings in its patch. Total area overed by it was estimated at 125 square miles, and the damage, exclusive of that to railroads, was estimated at $2,451,600, of which almost a million dollars was to highways, bridges, and buildings. A second and smaller overflow of the Republican on the 19th–21st caused little additional damage.

The Solomon River overflowed a large area in the vicinity of Beloit, reaching the record-breaking crest on the 3d and lesser crests on the 19th and 29th. Two overflows occurred at Niles. Total damage along this stream was placed at $477,575. The Smoky Hill overflowed four times at Lindsborg, reaching crests on the 5th, 16th, 21st, and 30th. At Salina it overflowed slightly on the 23d and at Enterprise on the 8th–10th. Total damaged was estimated at $263,500.

The crest of the Republican connected very closely with the crest of a rather serious overflow at the Blue at Manhattan and resulted in a stage at that place that slightly exceeded the great overflow of 1903. This crest tended to flatten out as it moved down the Kansas Valley. It approximated the 1908 highwater marks at Wamego and Topeka and fell below them at Lawrence